US010608317B2

(12) **United States Patent**
Pu et al.

(10) **Patent No.: US 10,608,317 B2**
(45) **Date of Patent: Mar. 31, 2020**

(54) **COMMUNICATION SYSTEM AND COMMUNICATION METHOD**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 266 days.

(21) Appl. No.: **15/919,232**

(22) Filed: **Mar. 13, 2018**

(65) **Prior Publication Data**

US 2018/0261905 A1 Sep. 13, 2018

Related U.S. Application Data

(60) Provisional application No. 62/470,368, filed on Mar. 13, 2017.

(51) **Int. Cl.**
H01Q 1/12 (2006.01)
G02B 27/01 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H01Q 1/1257*** (2013.01); ***G02B 27/017*** (2013.01); ***G02B 27/0176*** (2013.01);
(Continued)

(58) **Field of Classification Search**
USPC 342/165–174
See application file for complete search history.

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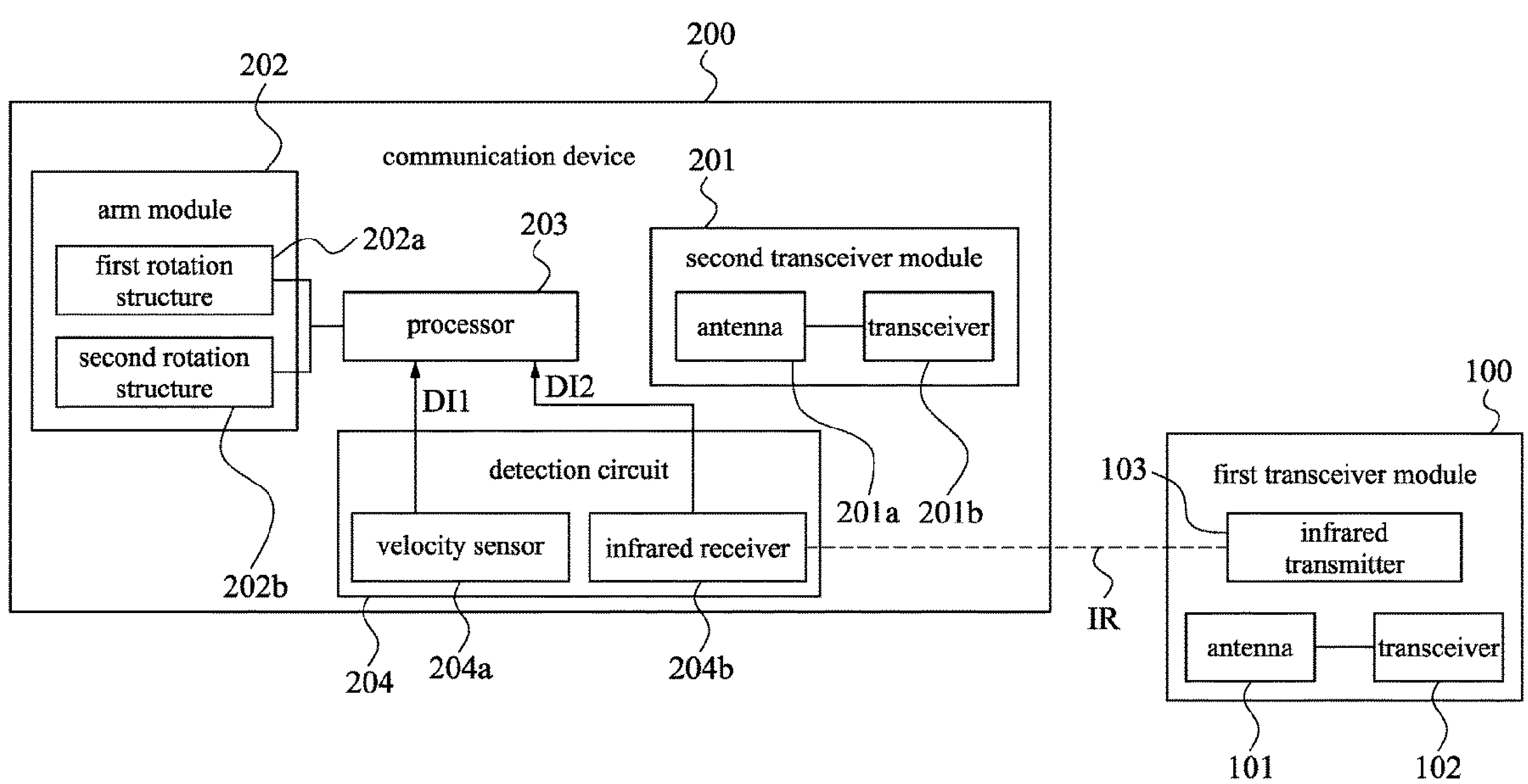
(57) **ABSTRACT**

A communication system, which is applied to a space, includes a first transceiver and a communication device. The first transceiver is fixedly disposed in the space. The communication device is movable in the space. The communication device includes a base, a second transceiver, a detection circuit, an arm and a processor. The second transceiver is oriented to an orientation and configured to build a signal transmission with the first transceiver. The detection circuit is configured to detect a displacement or rotation of the communication device with respect to the first transceiver, in order to generate detection information. One end of the arm is connected to the base, and another end of the arm is connected to the second transceiver. The processor is configured to control an operation of the arm according to the detection information, in order to maintain the orientation of second transceiver directing to the first transceiver.

18 Claims, 9 Drawing Sheets



(51) **Int. Cl.**

H01Q 1/08	(2006.01)
H01Q 1/27	(2006.01)
H01Q 5/22	(2015.01)
H01Q 1/18	(2006.01)
H01Q 3/08	(2006.01)
H04B 1/40	(2015.01)
G08C 23/04	(2006.01)
H01Q 1/00	(2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 1/084*** (2013.01); ***H01Q 1/1264*** (2013.01); ***H01Q 1/185*** (2013.01); ***H01Q 1/276*** (2013.01); ***H01Q 3/08*** (2013.01); ***H01Q 5/22*** (2015.01); *G02B 2027/0138* (2013.01); *G02B 2027/0187* (2013.01)

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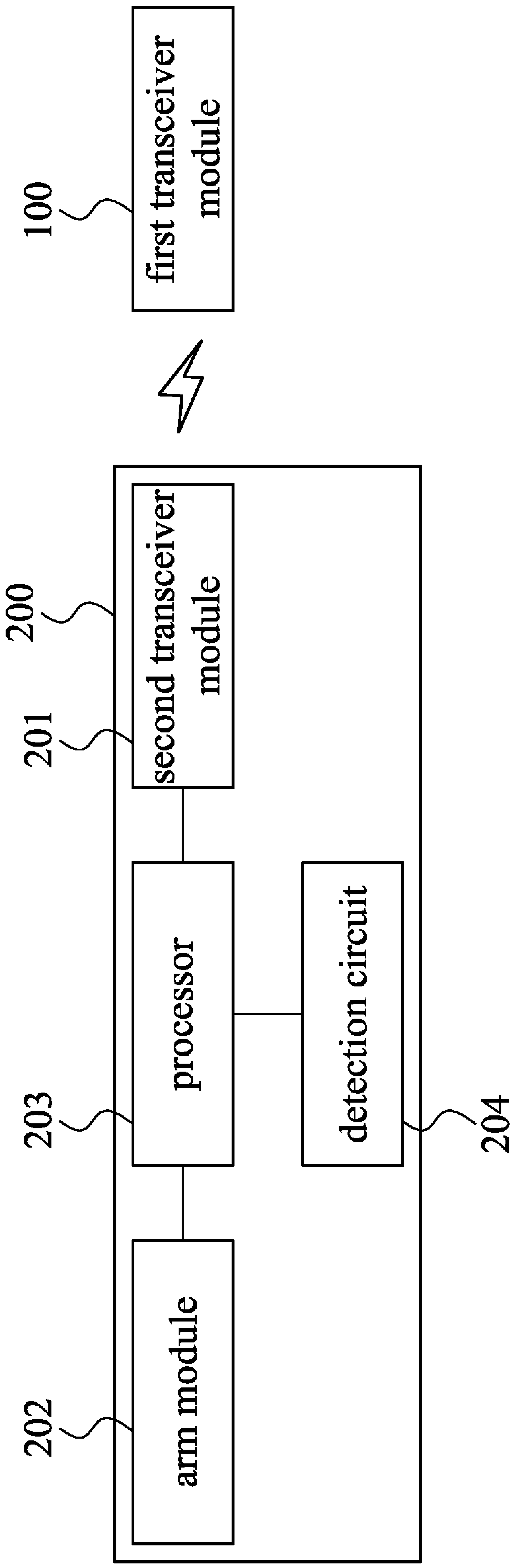
100
first transceiver module
200
201
second transceiver module
processor
203
detection circuit
204
arm module
202

Fig. 1

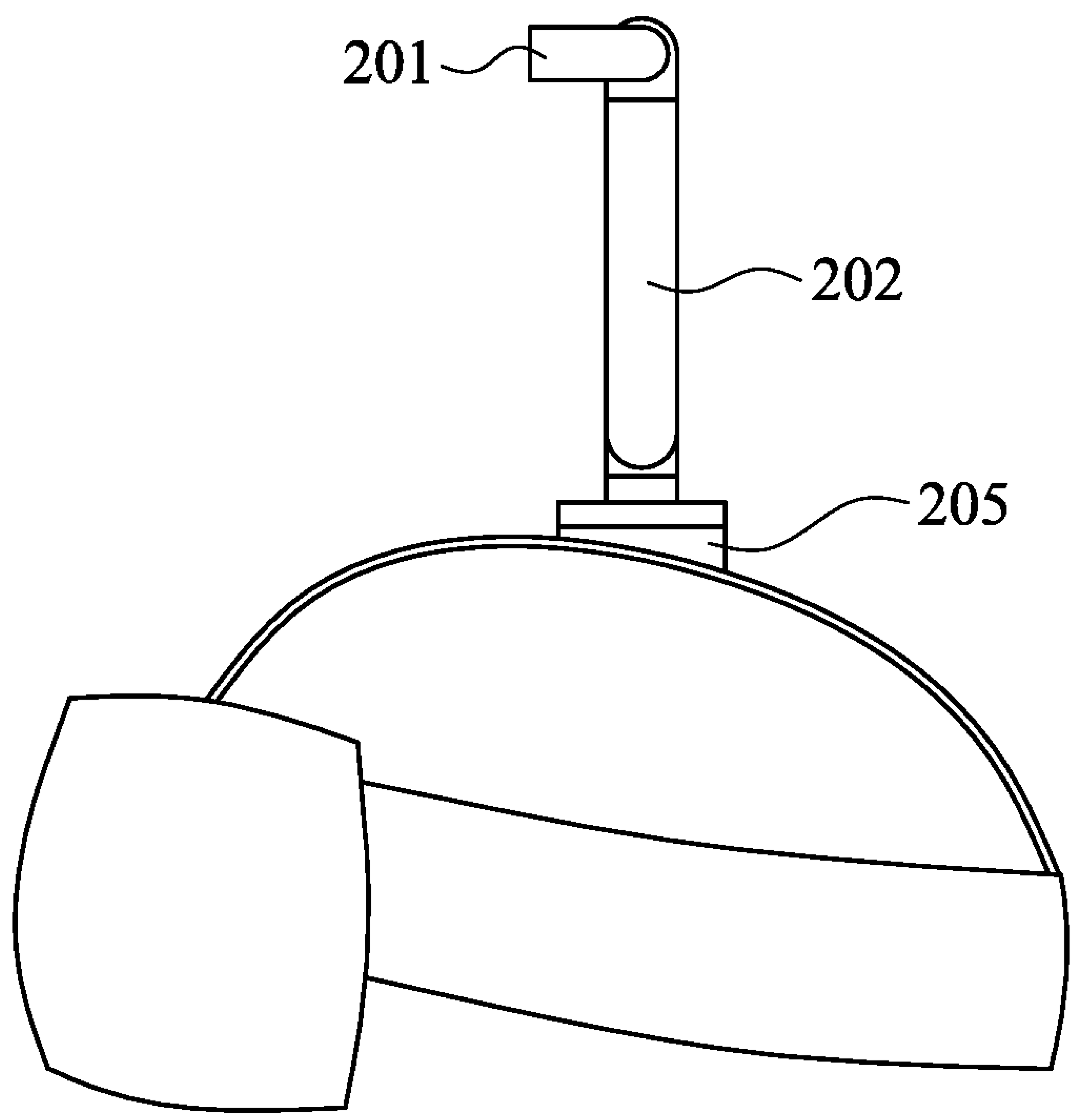

Fig. 2

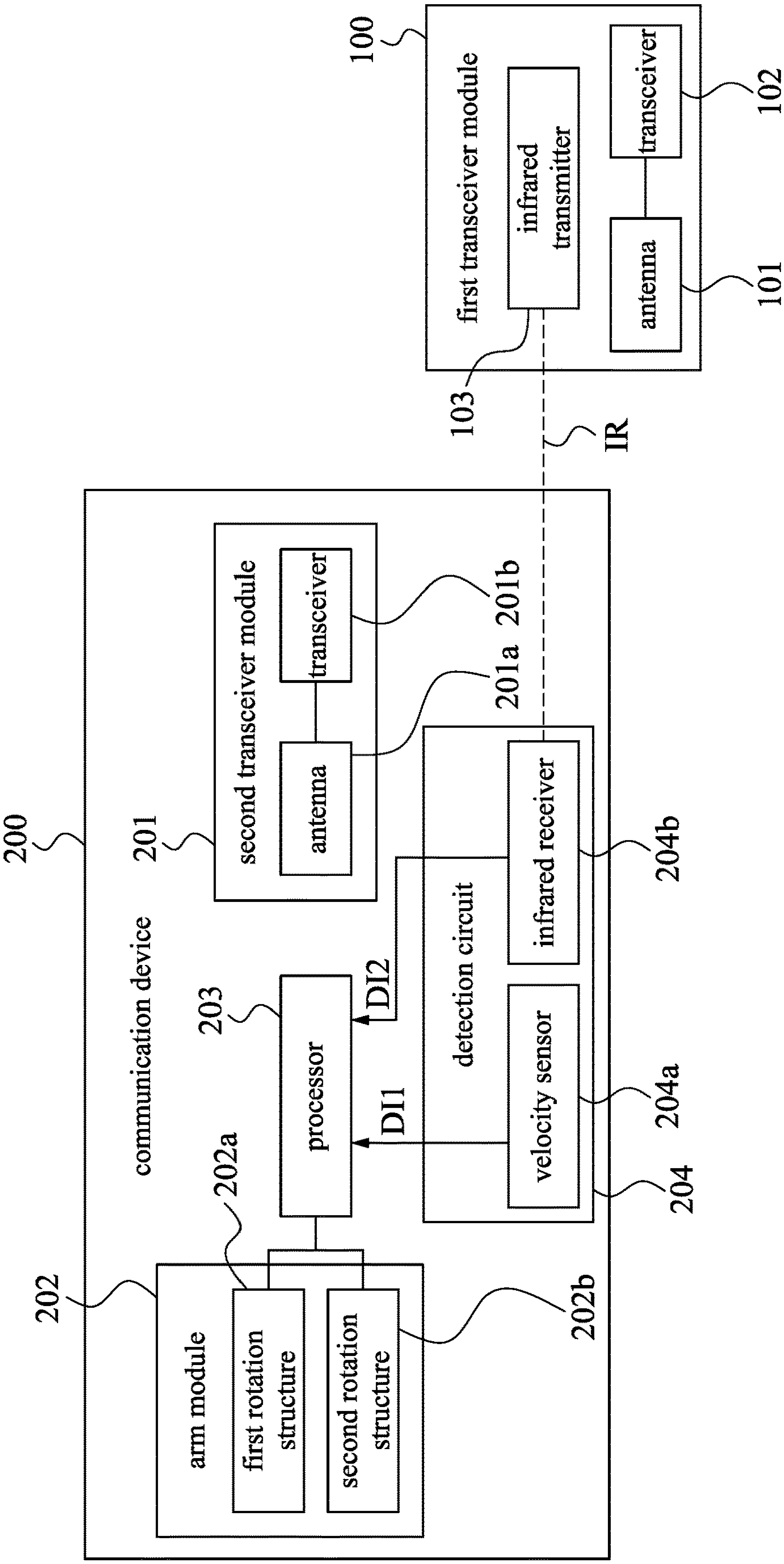
100
first transceiver module
infrared transmitter
transceiver
antenna
101
102
103
IR
200
communication device
201
second transceiver module
antenna
transceiver
201a
201b
202
arm module
first rotation structure
second rotation structure
202a
202b
203
processor
DI1
DI2
204
detection circuit
velocity sensor
infrared receiver
204a
204b

Fig. 3

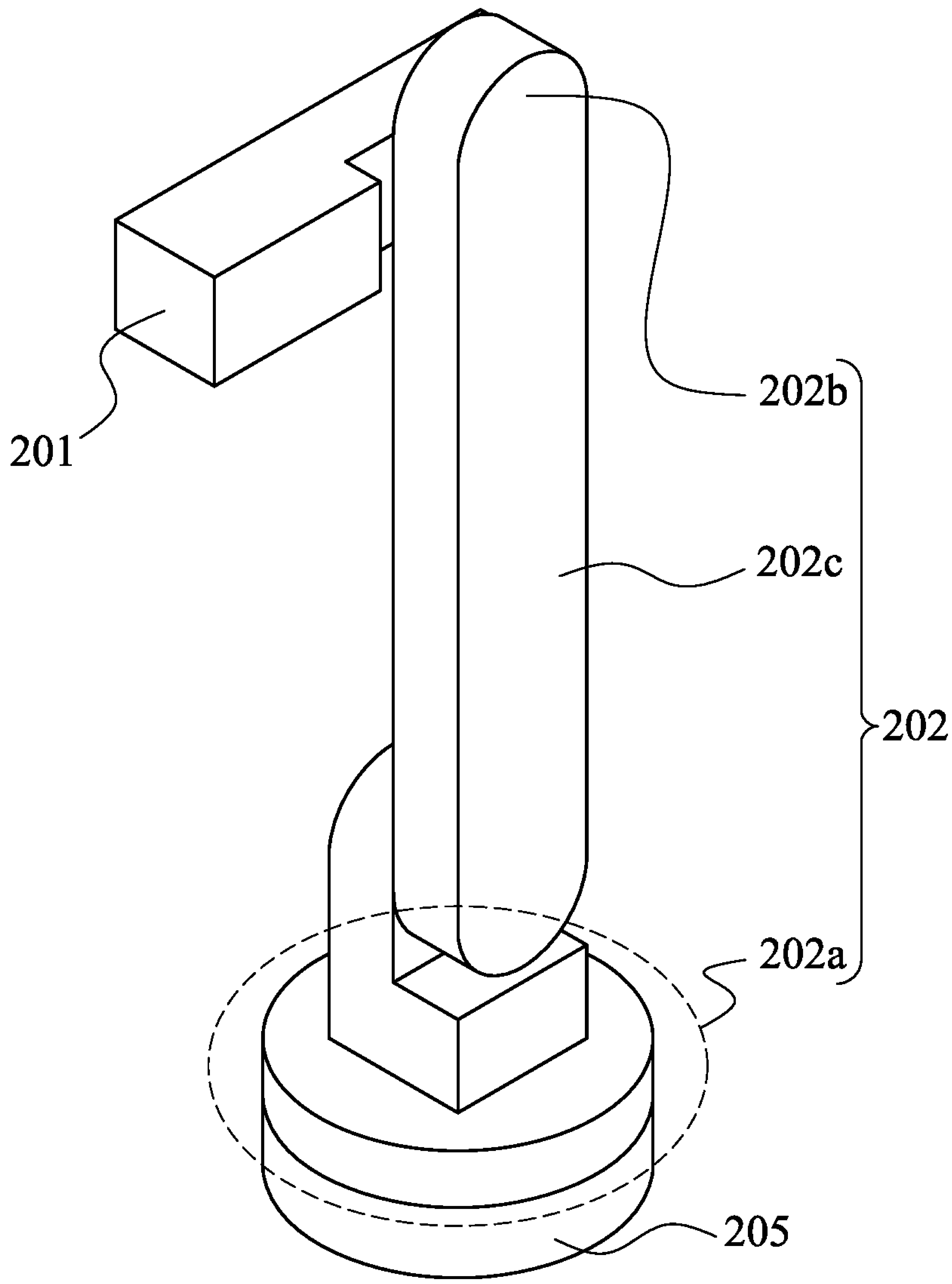

Fig. 4

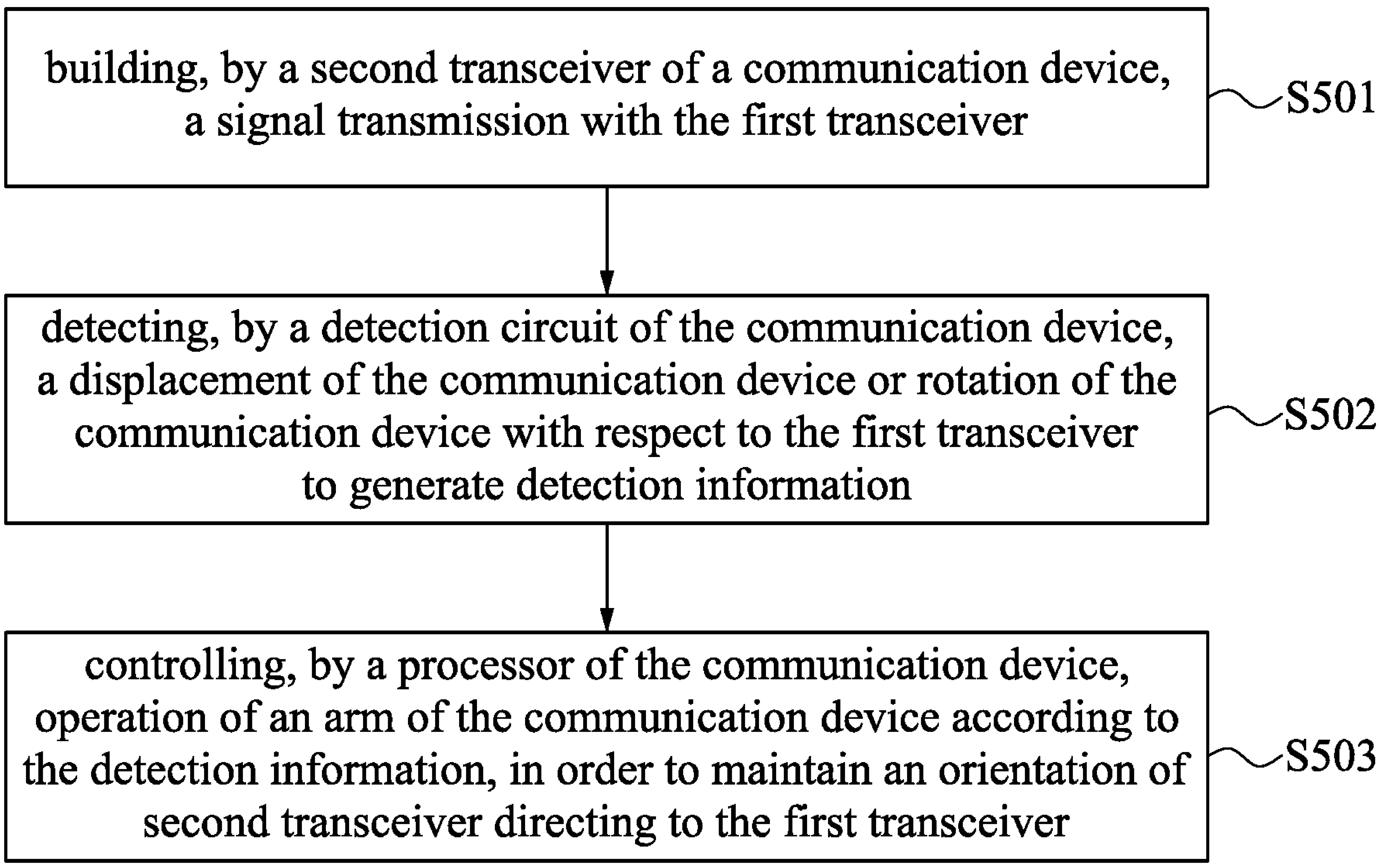
building, by a second transceiver of a communication device, a signal transmission with the first transceiver
S501
detecting, by a detection circuit of the communication device, a displacement of the communication device or rotation of the communication device with respect to the first transceiver to generate detection information
S502
controlling, by a processor of the communication device, operation of an arm of the communication device according to the detection information, in order to maintain an orientation of second transceiver directing to the first transceiver
S503

Fig. 5

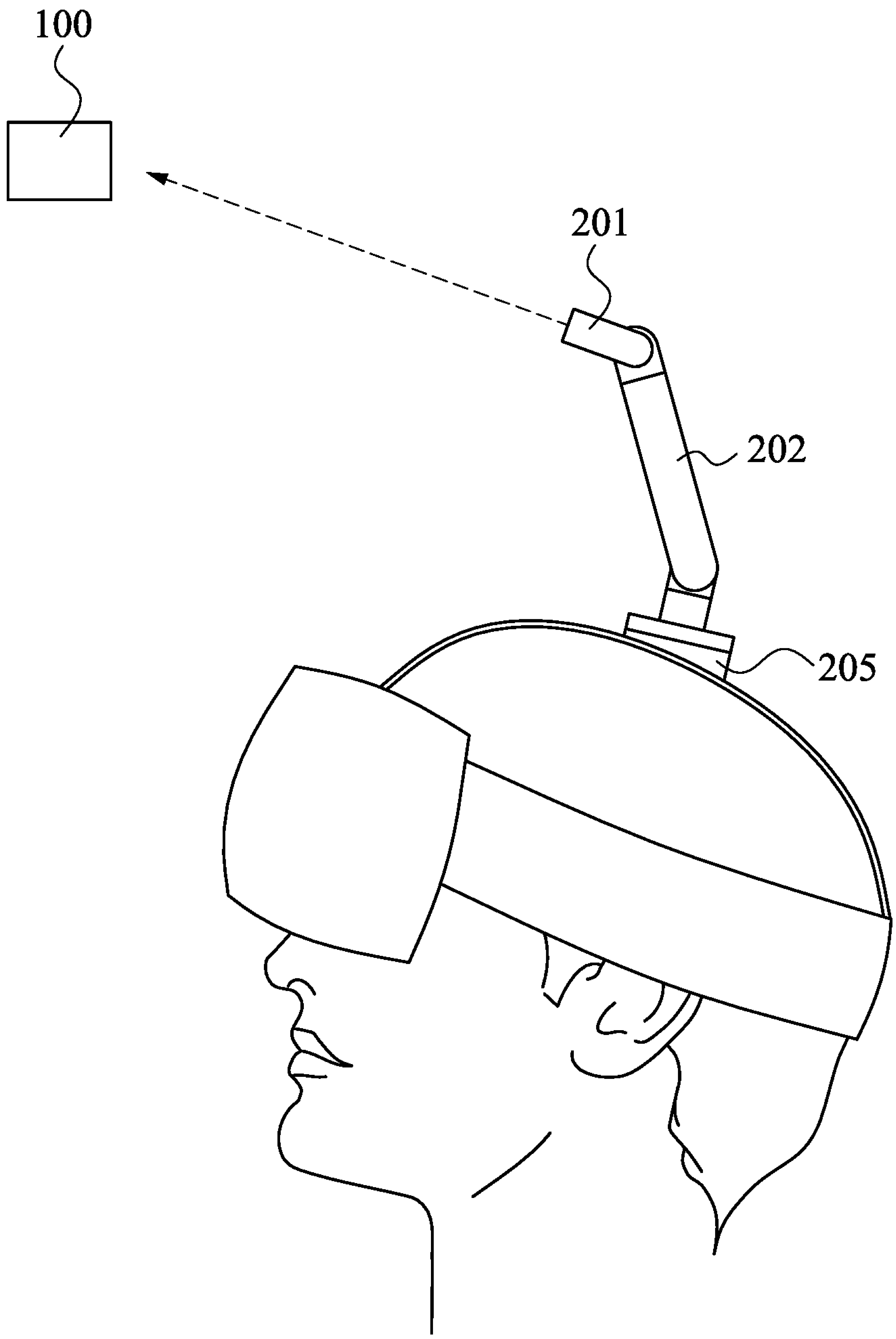

Fig. 6A

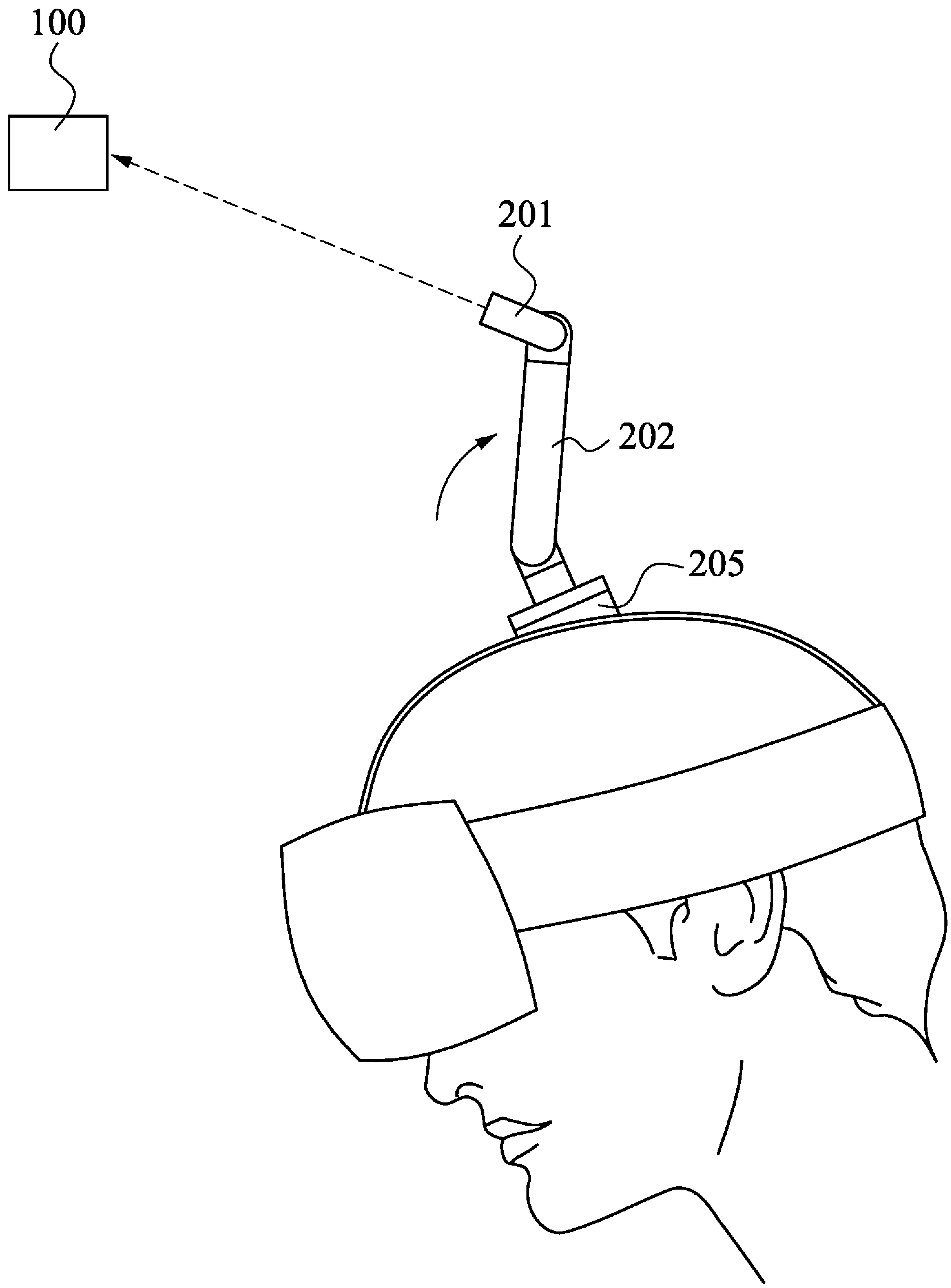

Fig. 6B

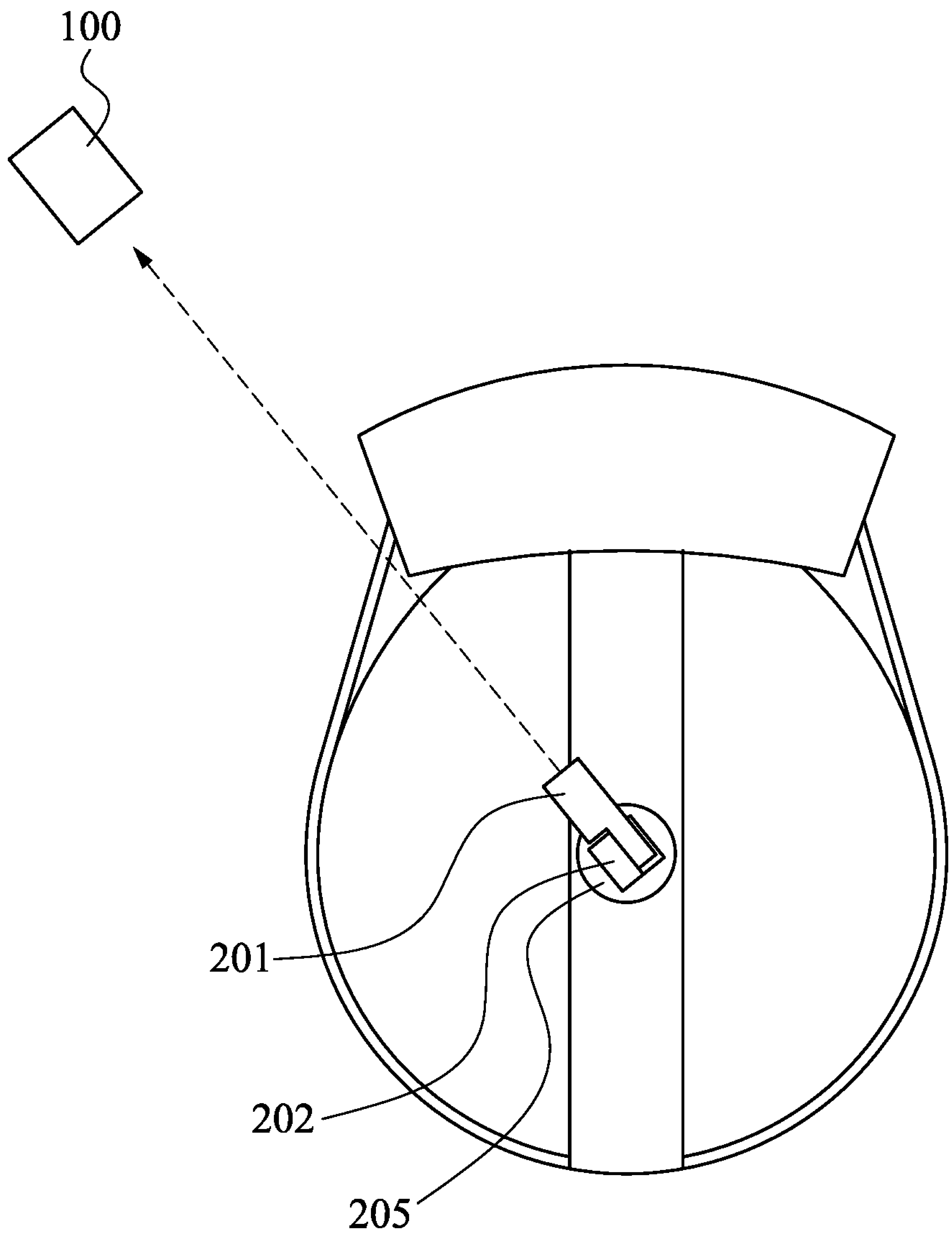

Fig. 7A

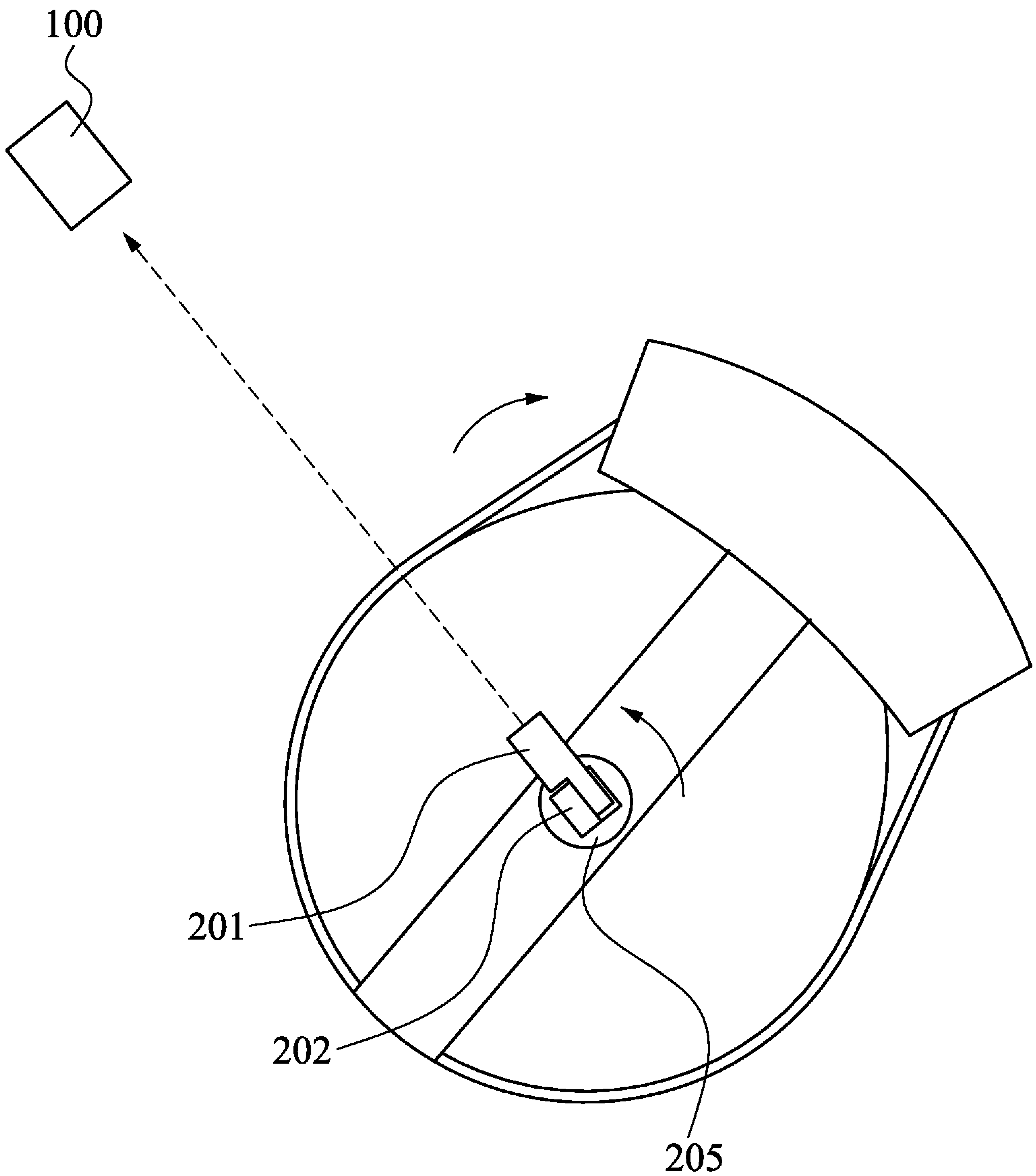

Fig. 7B

COMMUNICATION SYSTEM AND COMMUNICATION METHOD

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. Provisional Application Ser. No. 62/470,368, filed on Mar. 13, 2017, which is herein incorporated by reference.

BACKGROUND

Technical Field

Present disclosure relates to a wireless communication system and a wireless communication method. More particularly, the present disclosure relates to the communication system and the communication method for adapting changes of relative position between transceivers.

Description of Related Art

Virtual reality technology is very powerful in many approaches. Currently, signal transmissions in most of the virtual reality systems are established through physical cables. If tries to build signal transmissions through wireless communication systems, existing phased-array antenna can be helpful. However, sight of the phased-array antenna disposed on head-mounted display is still vulnerable to the blind spots shaded by the user's head.

SUMMARY

The disclosure relates to a communication system applied to a space. The communication system comprises a first transceiver and a communication device. The first transceiver is fixedly disposed in the space. The communication device is movable in the space. The communication device comprises a base, a second transceiver, a detection circuit, an arm and a processor. The second transceiver is oriented to an orientation. The second transceiver is configured to build a signal transmission with the first transceiver. The detection circuit is configured to detect a displacement or a rotation of the communication device with respect to the first transceiver, in order to generate detection information. The arm is disposed on the base to carry the second transceiver. The arm is operative over the base. The processor is electrically coupled to the arm. The processor is configured to control an operation of the arm according to the detection information, in order to maintain the orientation of second transceiver directing to the first transceiver.

An aspect of the disclosure is related to a communication method employed in a space. A first transceiver is fixedly disposed in the space. The communication method comprises following steps: building, by a second transceiver of a communication device, a signal transmission with the first transceiver; detecting, by a detection circuit of the communication device, a displacement of the communication device or rotation of the communication device with respect to the first transceiver in order to generate detection information; and controlling, by a processor of the communication device, an operation of an arm of the communication device according to the detection information, in order to maintain an orientation of second transceiver directing to the first transceiver.

It is to be understood that both the foregoing general description and the following detailed description are by examples, and are intended to provide further explanation of the disclosure as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

Present disclosure can be more fully understood by reading the following detailed description of the embodiments, with reference made to the accompanying drawings as follows:

FIG. **1** is a schematic diagram of a communication system according to an embodiment of present disclosure.

FIG. **2** is a schematic diagram of a communication device according to an embodiment of present disclosure.

FIG. **3** is a schematic diagram of a communication system according to an embodiment of present disclosure.

FIG. **4** is a schematic diagram of a communication device in part according to an embodiment of present disclosure.

FIG. **5** is a flow chart of a communication method according to an embodiment of present disclosure.

FIG. **6**A is a schematic diagram of a communication device according to an embodiment of present disclosure.

FIG. **6**B is a schematic diagram of a communication device according to an embodiment of present disclosure.

FIG. **7**A is a schematic diagram of a communication device according to an embodiment of present disclosure.

FIG. **7**B is a schematic diagram of a communication device according to an embodiment of present disclosure.

DETAILED DESCRIPTION

Reference will now be made in detail to the present embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

It will be understood that, although the terms "first," "second," etc., may be used herein to describe various elements, these elements should not be limited by these terms. These terms are used to distinguish one element from another.

In the following description and claims, the terms "coupled" and "connected", along with their derivatives, may be used. In particular embodiments, "connected" and "coupled" may be used to indicate that two or more elements are in direct physical or electrical contact with each other, or may also mean that two or more elements may be in indirect contact with each other. "Coupled" and "connected" may still be used to indicate that two or more elements cooperate or interact with each other.

As used herein, the terms "comprising," "including," "having," and the like are to be understood to be open-ended, i.e., to mean including but not limited to.

As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

As used herein, the direction of terms, such as "Up," "Down," "Left," "Right," "top," "bottom," etc, are understood to be a reference direction of the attached drawings. Therefore, the direction of terms used herein are to describe and understand the present disclosure, and not to limit the present disclosure.

The terms used in this specification generally have their ordinary meanings in the art and in the specific context where each term is used. The use of examples in this specification, including examples of any terms discussed herein, is illustrative only, and in no way limits the scope and meaning of the disclosure or of any exemplified term. Likewise, the present disclosure is not limited to various embodiments given in this specification.

FIG. **1** is a schematic diagram of a communication system according to an embodiment of present disclosure. As shown in FIG. **1**, in the embodiment, the communication system includes a first transceiver module **100** and a communication device **200**. The first transceiver module **100** and the communication device **200** are both disposed in a space. The space may be, but not limited to, a room, chamber or exhibition hall, etc. In some embodiments, the first transceiver module **100** is fixedly disposed at a position in the space. For instance, if the space is a room, the first transceiver module **100** may be attached to the walls or ceiling of the room. Alternatively, the first transceiver module **100** may be mounted on a support fixed at a position in the space. Different from the first transceiver module **100**, the communication device **200**, in operation, is movable in the space. In the embodiment, the communication device **200** may be a head-mounted display. The communication device **200** may be mounted on a user's head. In this case, when the user moves in the space or the user rotates his/her head, the communication device **200** being carried moves or rotates accordingly.

As shown in FIG. **1**, in the embodiment, the communication device **200** includes a second transceiver module **201**, an arm module **202**, a processor **203** and a detection circuit **204**. The processor **203** is electrically coupled to the second transceiver module **201**, the arm module **202** and the detection circuit **204**. As mentioned, in the embodiment, the communication device **200** is the head-mounted display, and the second transceiver module **201** is used to transmit signals with the first transceiver module **100**.

For better understandings, reference can be made to FIG. **2** of present disclosure. FIG. **2** is a schematic diagram of a communication device according to an embodiment of present disclosure. In the embodiment, the appearance of the communication device **200** is shown. As shown in FIG. **2**, the communication device **200** is mounted with a base **205**. One end of the arm module **202** is pivotably connected to the base **205**. Another end of the arm module **202** is pivotably connected to the second transceiver module **201**. Thus, the arm module **202** is operative to perform rotational motion or translational displacement over the base **205**. When the arm module **202** performs such actions, the second transceiver module **201** carried by the arm module **202** can be oriented to an orientation. It is to say, the arm module **202** is employed to control the orientation of the second transceiver module **201**. In the embodiment, when the communication device **200** is moved in the space, the arm module **202** is used to hold the second transceiver module **201** oriented to the first transceiver module **100**, so that the stability of the signal transmission between the second transceiver module **201** and the first transceiver module **100** is ensured.

FIG. **3** is a schematic diagram of a communication system according to an embodiment of present disclosure. As shown in FIG. **3**, in the embodiment, the components of the communication system of FIG. **1** are illustrated in detail. As shown in FIG. **3**, in the embodiment, the first transceiver module **100** includes an antenna **101**, a transceiver **102** and an infrared transmitter **103**. The antenna **101**, for example, may be a millimeter-wave frequency antenna having a first orientation. Since the first transceiver module **100** is fixedly disposed at a specific position in the space, the first orientation of the first transceiver module **100** is fixed. In the embodiment, the transceiver **102** is electrically coupled to the antenna **101**. The transceiver **102** may transmit or receive radio frequency signal via the antenna **101**. The infrared transmitter **103** is configured to send infrared signal IR toward the space.

As shown in FIG. **3**, in the embodiment, the second transceiver module **201** includes an antenna **201***a* and a transceiver **201***b*. The antenna **201***a*, for example, may be a millimeter-wave frequency antenna having a second orientation. The transceiver **201***b* is electrically coupled to the antenna **201***a*. The transceiver **201***b* may transmit or receive radio frequency signal via the antenna **201***a*. Moreover, as shown in FIG. **3**, in the embodiment, the detection circuit **204** includes a speed sensor **204***a* and an infrared receiver **204***b*. The speed sensor **204***a* is configured to detect an acceleration of the communication device **200** or an angular acceleration of the communication device **200**, in order to generate first detection information DI1. The infrared receiver **204***b* is configured to receive infrared signal IR sent by the infrared transmitter **103** to generate second detection information DI2. As described in following paragraphs, in some embodiments, the processor **203** may control the operation of the arm module **202** and the second transceiver module **201** according to the first detection information DI1 and/or the second detection information DI2. Thus, the signal transmission between the communication device **200** and the first transceiver module **100** may be ensured.

As shown in FIG. **3**, in the embodiment, the arm module **202** includes a first rotation structure **202***a*, a second rotation structure **202***b* and an arm body **202***c*. In some embodiments, a length of the arm module **202** is substantially equal to a radius of the communication device **200** (the head-mounted display). In this case, no matter how the user's head rotates or moves, the operation of the arm module **202** may keep a sight of the second transceiver module **201** being not shaded by the communication device **200**.

For better understandings, reference can be made to FIG. **4** of present disclosure. FIG. **4** is a schematic diagram of a communication device in part according to an embodiment of present disclosure. As shown in FIG. **4**, the first rotation structure **202***a* is pivotably connected the arm body **202***c* with the base **205**. The first rotation structure **202***a* provides an mechanism allowing the arm body **202***c* to be rotated around the base **205** along at least four directions (vertically and horizontally). Similarly, the second rotation structure **202***b* is pivotably connected the arm body **202***c* with the second transceiver module **201**. The second rotation structure **202***b* provides the second transceiver module **201** to be rotated around the arm body **202***c* along at least two directions (vertically). The operations of the first rotation structure **202***a* and the second rotation structure **202***b* allow the arm body **202***c* to be rotated or swung around the base **205**. Thus, the second orientation of the antenna **201***a* can be controlled. It is noted that the configuration of FIG. **4** is given for illustrative purposes, and the present disclosure is not limited thereto. In some embodiments, the second rotation structure **202***b* provides the second transceiver module **201** to be rotated around the arm body **202***c* along at least four directions (vertically and horizontally). In this case, more available operations of the arm body **202***c* rotated over the base **205** may be provided.

The first rotation structure **202***a* and the second rotation structure **202***b* may be implemented with several connecting components. For example, each of the first rotation structure

202*a* and the second rotation structure **202***b* includes a connecting shaft and a rotation joint (not shown in figure) disposed on the arm body, and the connecting shaft and the rotation joint are connected to perform said operations. The above implementations are given for illustrative purposes, and various implementations of the first rotation structure **202***a* or the second rotation structure **202***b* are within the contemplated scope of the present disclosure.

As shown in FIG. **1** and FIG. **3**, in the embodiment, the second transceiver module **201**, the arm module **202** and the detection circuit **204** of the communication device **200** are all electrically coupled to the processor **203**. For example, the processor **203** may be a single processor or an integration of multiple microprocessors. The processor **203** may be connected to internal memories or external memories (not shown in figure) via buses. The internal memories or external memories may be volatile or non-volatile memories. The processor **203** is configured to retrieve a plurality of instructions from the internal memories or external memories, and to execute these instructions for certain predetermined processes. It is noted that the predetermined processes may be described in following paragraphs.

FIG. **5** is a flow chart of a communication method according to an embodiment of present disclosure. In the embodiment, an association of the communication device **200** and the first transceiver module **100** establishes such communication method. For better understandings, references are now made to the embodiments of FIG. **1-4**. In the embodiment, the steps of the communication method are described in details.

Step S**501**: building, by the second transceiver module **201** of the communication device **200**, the signal transmission with the first transceiver module **100**. As shown in FIG. **1-4**, in the embodiment, the first transceiver module **100** is fixedly disposed in the space but the communication device **200** is movable in the space. As mentioned, the transceiver **102** of the first transceiver module **100** may transmit radio frequency signals toward the first orientation via the antenna **101**, or receive radio frequency signals therefrom. Similarly, the second transceiver module **201** of the communication device **200** includes the antenna **201***a* and the transceiver **201***b*. The transceiver **201***b* may transmit radio frequency signals toward the second orientation via the antenna **201***a*, or receive radio frequency signals therefrom.

In some embodiments, when the first orientation of the antenna **101** is substantially aligned to the second orientation of antenna **201***a* (as the line of sight described below), the transmission efficiency between the second transceiver module **201** of the communication device **200** and the first transceiver module **100** may be increased.

Step S**502**: detecting, by the detection circuit **204** of the communication device **200**, a displacement of the communication device **200** or rotation of the communication device **200** with respect to the first transceiver module **100** to generate detection information. The detection information may be provided as coordinates or relative positions in the space. For instance, when the communication device **200** is moved or rotated in the space, the speed sensor **204***a* may detect an acceleration of the communication device **200** or angular acceleration of the communication device **200** for the generation of the first detection information DI**1**. The infrared receiver **204***b* may receive the infrared signal IR sent from the infrared transmitter **103** for the generation of the second detection information DI**2**.

More specifically, in one embodiment, the speed sensor **204***a* at least includes an accelerometer and a gyroscope (not shown). The accelerometer is configured to measure the acceleration of the communication device **200** with respect to an initial point of the space. The speed sensor **204***a* may obtain the displacement of the communication device **200** in the space according to the acceleration. The gyroscope is configured to measure the angular acceleration of the communication device **200** with respect to an initial point of the space. The speed sensor **204***a* may obtain the angular displacement of the communication device **200** in the space according to the acceleration. The speed sensor **204***a* may generate the first detection information DI**1** based on the displacement and the angular displacement of the communication device **200**.

More specifically, in an embodiment, the infrared transmitter **103** may transmit plurality of infrared signal IR, in several cycles, to scan the space. When the infrared receiver **204***b* receives the infrared signals IR, the time that the infrared signal IR is received may be processed for a determination of a relative distance or relative angle between the infrared receiver **204***b* and the second transceiver module **201**. As mentioned, the infrared receiver **204***b* may generate the second detection information DI**2** according to the relative distance or the relative angle. Based on the second detection information DI**2**, the processor **203** may determine whether to adapt the second transceiver module **201** to the first transceiver module **100** by moving the arm module **202**.

It is noted that the embodiment shown in FIG. **3** is not intend to limit the scope of present disclosure. In some embodiments, the infrared receiver **204***b* of the communication device **200** may be replaced by an optical capturing device. Correspondingly, the infrared transmitter **103** of the first transceiver module **100** may be replaced by an optical reference point. In this case, the optical capturing device is configured to track a position of the optical reference point on the first transceiver module **100** in order to generate the second detection information DI**2**. As mentioned, the first detection information DI**1** and the second detection information DI**2** include information indicating the displacement or rotation of the communication device **200** with respect to the first transceiver module **100**. The first detection information DI**1** and the second detection information DI**2** are then sent to the processor **203**.

Step S**503**: controlling, by the processor **203** of the communication device **200**, operation of the arm module **202** of the communication device **200** according to the detection information, in order to maintain an orientation of second transceiver module **201** directing to the first transceiver module **100**.

As shown in FIG. **1-4**, in the embodiment, as long as the communication device **200** is in operation, the processor **203** of the communication device **200** may control the first rotation structure **202***a* and the second rotation structure **202***b* to rotate or swing the arm module **202**. As a result, the second orientation of the second transceiver module **201** may be substantially aligned to the first orientation of the first transceiver module **100**, it forms a line of sight from the second transceiver module **201** to the first transceiver module **100**. By maintaining the line of sight, the signal transmission efficiency of the second transceiver module **201** and the first transceiver module **100** may be improved.

As mentioned, once the signal transmission between the second transceiver module **201** and the first transceiver module **100** is built successfully, a signal strength (RSSI) indicating the transmission quality may be measured by the second transceiver module **201**. The processor **203** may rotate or swing the arm module **202** in a continuous manner, and record the signal strengths measured by the second transceiver module **201** (e.g. recorded in said memories). Based on the signal strengths, the processor **203** may control the arm module **202** to maintain current signal strength of the signal transmission over (or equal to) a strength threshold. For example, in some embodiments, the strength threshold is determined according to maximum signal strength among these signal strengths, such as the maximum signal strength of itself or signal strength slightly lower than the maximum. In this case, the processor **203** may control the arm module **202** to maintain current signal strength of the second transceiver module **201** approaching the maximum signal strength.

In the embodiment, the processor **203** may receive the first detection information DI**1** and the second detection information DI**2** obtained by the detection circuit **204**, and control the operation of the arm module **202** according to the first detection information DI**1** and the second detection information DI**2**. As a result, the first orientation and the second orientation may still be aligned when the user is moving, and the signal strength of the signal transmission may be maintained.

More specifically, in some embodiments, the first detection information DI**1** carry information indicating the acceleration of the communication device **200** or the angular acceleration of the communication device **200** when the communication device **200** is moved or rotated. Accordingly, the processor **203** may drive the arm module **202** according to the acceleration or the angular acceleration, in order to maintain the arm module **202** as perpendicular to a ground of the space. Under this condition, the second transceiver module **201**, mounted on the arm module **202**, may have a decent angle for transmit and/or receive signals, and the arm module **202** may have more space for rotating or swinging in following cycles. In addition, the processor **203** may calculate a relative distance or relative position between communication device **200** and the first transceiver module **100** according to the first detection information DI**1** and/or the second detection information DI**2**. The operation of the arm module **202** is determined according to side relative distance or relative position. As such, the second orientation of the second transceiver module **201** is held to be oriented to the first transceiver module **100**, and the line of sight from the second transceiver module **201** to the first transceiver module **100** may be maintained.

In the embodiment, when the user's head rotates or moves along vertical axis, the first detection information DI**1** carry information indicating the angle acceleration about the rotation of the communication device **200**, the processor **203** may control the operation of the arm module **202** according to the first detection information DI**1**. The arm module **202** is controlled to rotate toward a direction opposite to the angle acceleration on the base **205**. Therefore, the second orientation of the second transceiver module **201** is kept being oriented to the first transceiver module **100**.

For better understandings, references are now made to FIG. **6**A and FIG. **6**B. FIG. **6**A and FIG. **6**B are both schematic diagrams of a communication device according to an embodiment of present disclosure. As shown in the lateral views of FIG. **6**A, when a downward rotation is reflected on the user's head (e.g. when the user heads down), the first detection information DI**1** carry information indicating the angular acceleration indicating the downward rotation. In this case, the processor **203** may control the arm module **202** to rotate, oppositely, against the angular acceleration, so that the line of sight from the second transceiver module **201** to the first transceiver module **100** may be maintained. As shown in the lateral views of FIG. **6**B, when an upward rotation is reflected on the user's head (e.g. when the user heads up), the first detection information DI**1** carry information indicating the angular acceleration that indicates the upward rotation. In this case, the processor **203** may control the arm module **202** to rotate, oppositely, against the angular acceleration, so that the line of sight from the second transceiver module **201** to the first transceiver module **100** may be maintained.

In the same manner, in the embodiment, when communication device **200** carried by the user is moved horizontally, the processor **203** may drive the arm module **202** correspondingly in order to keep the second orientation of the second transceiver module **201** directing to the first transceiver module **100**.

For better understandings, references are now made to FIG. **7**A and FIG. **7**B. FIG. **7**A and FIG. **7**B are both schematic diagrams of a communication device according to an embodiment of present disclosure. As shown in the above views of FIG. **7**A and FIG. **7**B, when a clockwise rotation is reflected on the user's head, the first detection information DI**1** carry information indicating the angular acceleration indicating the clockwise rotation. In this case, the processor **203** may control the arm module **202** to rotate, oppositely, against the angular acceleration, so that the line of sight from the second transceiver module **201** to the first transceiver module **100** may be maintained.

In foregoing embodiments, the processor **203** of the communication device **200** may operates the arm module **202** according to above processes. Thus, the signal strength of the second transceiver module **201** may be kept being as the maximum signal strength, approximately. It prevents the disconnection between the second transceiver module **201** and the first transceiver module **100**. The stability of signal transmission is therefore improved.

As mentioned, in the application, the communication device **200** may be the head-mounted display. On the other hand, the first transceiver module **100** fixed in space may be communicatively coupled to a host computer. Therefore, present disclosure provides an improved connection approach between the head-mounted display and the host computer. The physical connection limitation between the communication device **200** and the host computer is removed. When the user is immersed in the virtual reality environment provided by the host computer, the first transceiver module **100** sends out radio frequency signals with information carried, and the second transceiver module **201** of the communication device **200** receives such radio frequency signals. Thus, wireless communication connecting the communication device **200** with the host computer is established. The user experience is therefore improved for the enlarged range of activity brought by the wireless communication.

It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present disclosure without departing from the scope or spirit of the disclosure. In view of the foregoing, it is intended that the present disclosure cover modifications and variations of this disclosure provided they fall within the scope of the following claims.

What is claimed is:

1. A communication system, applied to a space, the communication system comprising:

a first transceiver fixedly disposed in the space; and

a communication device disposed in the space, wherein the communication device is movable in the space, and the communication device comprises:

a base;

a second transceiver oriented to an orientation, the second transceiver configured to build a signal transmission with the first transceiver;

a detection circuit, configured to detect a displacement or a rotation of the communication device with respect to the first transceiver, in order to generate detection information;

an arm disposed on the base to carry the second transceiver, the arm is operative over the base; and

a processor electrically coupled to the arm, the processor configured to control an operation of the arm according to the detection information, in order to maintain the orientation of second transceiver directing to the first transceiver.

2. The communication system of claim **1**, wherein the processor is configured to control the operation of the arm to maintain a signal strength of the signal transmission being higher than a strength threshold.

3. The communication system of claim **1**, the communication device further comprises:

a first rotation structure pivotably connected between the arm and the base; and

a second rotation structure pivotably connected between the arm and the second transceiver,

wherein when the communication device is moved in the space, the processor is configured to control the operation of the arm with the first rotation structure and the second rotation structure to control the operation of the arm.

4. The communication system of claim **1**, wherein the detection circuit further comprises:

a speed sensor electrically coupled to the processor, wherein when the communication device is moved in the space, the speed sensor is configured to detect an acceleration of the communication device or an angular acceleration of the communication device, in order to generate the detection information.

5. The communication system of claim **4**, wherein the processor controls the operation of the arm according to the detection information, in order to maintain a coaxial of the arm substantially perpendicular to a ground of the space.

6. The communication system of claim **4**, wherein the processor controls the operation of the arm according to the detection information to rotate the arm to a direction opposite to the angular acceleration of the communication device.

7. The communication system of claim **1**, wherein the detection circuit further comprises:

an infrared receiver electrically coupled to the processor, wherein when the communication device is moved in the space, the infrared receiver tracks an infrared signal transmitting from an infrared transmitter of the first transceiver, in order to generate the detection information.

8. The communication system of claim **1**, wherein the detection circuit further comprises:

an optical capturing device electrically coupled to the processor, wherein when the communication device is moved in the space, the optical capturing device tracks a position of an optical reference disposed on the first transceiver to generate the detection information.

9. The communication system of claim **1**, wherein the base is disposed on a top surface of a head-mounted display.

10. The communication system of claim **9**, wherein a length of the arm is substantially equal to a radius of the head-mounted display.

11. A communication method, applied to a space in which a first transceiver is fixedly disposed, the communication method comprises:

building, by a second transceiver of a communication device, a signal transmission with the first transceiver;

detecting, by a detection circuit of the communication device, a displacement of the communication device or rotation of the communication device with respect to the first transceiver in order to generate detection information; and

controlling, by a processor of the communication device, an operation of an arm of the communication device according to the detection information, in order to maintain an orientation of second transceiver directing to the first transceiver.

12. The communication method of claim **11**, wherein the processor is configured to control the operation of the arm to maintain a signal strength of the signal transmission being higher than a strength threshold.

13. The communication method of claim **11**, further comprising:

when the communication device is moved in the space, detecting, by a speed sensor of the detection circuit, an acceleration of the communication device or an angular acceleration of the communication device, in order to generate the detection information.

14. The communication method of claim **13**, wherein the processor controls the operation of the arm according to the detection information, in order to maintain a coaxial of the arm substantially perpendicular to a ground of the space.

15. The communication method of claim **13**, wherein the processor controls the operation of the arm according to the detection information to rotate the arm to a direction opposite to the angular acceleration of the communication device.

16. The communication method of claim **11**, further comprising:

when the communication device is moved in the space, tracking, by an infrared receiver of the detection circuit, an infrared signal transmitting from an infrared transmitter of the first transceiver, in order to generate the detection information.

17. The communication method of claim **11**, further comprising:

when the communication device is moved in the space, tracking, by an optical capturing device of the detection circuit, a position of an optical reference disposed on the first transceiver, in order to generate the detection information.

18. The communication method of claim **11**, wherein the communication device is a head-mounted display.

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